

The Intensive Respiratory Care Unit

An Approach to the Care of Acute Respiratory Failure

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■ *An organized approach for the management of acute respiratory failure in an intensive general care unit utilizes a team of consultants including a general physician, a surgeon, respiratory care nurses, physical therapists and a blood gas technician. Because this team provides consultation and technical assistance in respiratory care and provides the equipment as well as the monitoring of care, this approach is suitable for any hospital interested in the management of acute respiratory emergencies.*

THE DEVELOPMENT of an organized team approach for the management of acute respiratory failure has been successful in improving the recovery rate of patients with acute respiratory failure from a variety of causes including chronic airway obstruction, surgical states, neurological problems and poisonings. Several units have been developed which bring together, in a physically distinct area, the disciplines of internal medicine, surgery, intensive nursing care and pulmonary physiology.^{2,4,6,7,9} Although each has been successful, it is recognized that, as described, they might not be administratively suitable or economically feasible for the vast majority of general medical and surgical hospitals, whether academically or community oriented. Hence the purpose of this report is to describe the organization and role of a consulting respiratory care unit which functions within a general intensive care area. The approach to care described herein has been found to be suitable for hospitals which operate a general intensive care unit.

The personnel and equipment for the respiratory

care consulting service is housed in a laboratory 18×36 feet which adjoins the general intensive care unit (Figure 1). This laboratory contains the ventilatory equipment for respiratory care, endotracheal and tracheostomy tubes, adapters and all the ancillary devices necessary for the management of patients with acute respiratory failure. The availability of instruments for blood gas analysis is fundamental for the diagnosis and management of respiratory failure; this equipment is maintained in the unit. A full-time blood gas technician calibrates and uses the equipment during daytime hours and physician consultants in respiratory care also avail themselves of this equipment at any time of day or night. A nurse specialist in respiratory care has administrative responsibilities for the functioning of the laboratory. This nurse has been fully trained in all aspects of inhalation therapy and supervises this facet of care within the intensive care unit. An aide is responsible for the cleansing and maintenance of the respiratory care equipment. The final responsibility for the supervision of professional aspects of the unit rests with a physician trained in respiratory care.

Patients are cared for in an adjacent 12-bed intensive care medical area which includes facilities for electrocardiographic and hemodynamic monitoring. Postoperative and trauma cases are

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Presented before the Section on Anesthesiology at the 96th Annual Session of the California Medical Association, Los Angeles, April 15 to 19, 1967.

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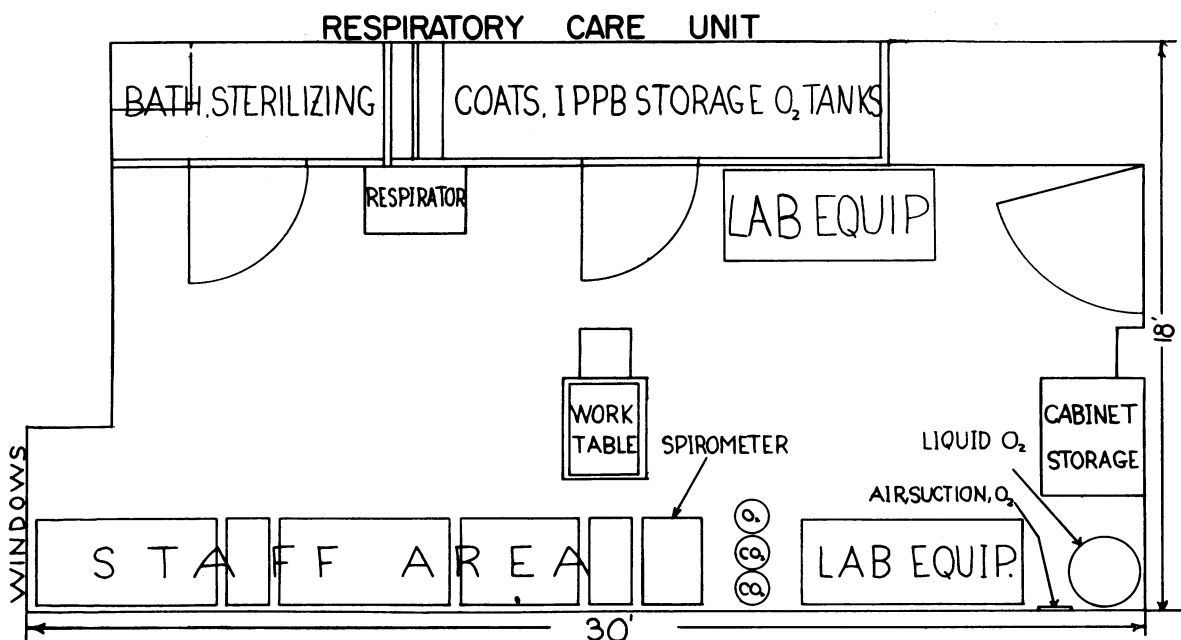


Figure 1.—Floor plan of the respiratory care laboratory. The laboratory houses the ventilators, (IPPB = intermittent positive pressure breathing) blood gas equipment and other monitory equipment, and provides office space for the respiratory care personnel. All facilities necessary for maintenance and sterilization of equipment are kept in the unit. The two CO₂ tanks are to supply the two concentrations needed for Astrup determination. The oxygen tank is used for calibration of the oxygen electrode. (Reproduced from Medical Clinics of North America³ by permission of the W. B. Saunders Company, Philadelphia.)

managed in a similar adjacent surgical area.

The purpose of the respiratory care unit is to provide personnel and equipment for the management of respiratory failure in both acute and extended care. The unit personnel provides consultation to the house staff (or private) physicians involved in the daily care of patients. When acute respiratory failure is suspected by clinical criteria,³ an arterial puncture—a simple procedure easily mastered by any physician⁸—is immediately performed by the physician in charge. In acute respiratory emergencies or after the diagnosis of respiratory failure has been confirmed in the laboratory, patients are transferred to the intensive care areas for bronchial hygiene, controlled low flow oxygen therapy or total ventilatory assistance as each requires.

The details of management of acute respiratory failure are beyond the scope of this communication. In principle, the management of respiratory failure can be divided into three phases: (1) emergency care and resuscitation, (2) definitive care and (3) early rehabilitation.³

In brief, profound hypoventilation or apnea is a medical emergency. Immediate steps must be taken to improve alveolar ventilation and oxygenation or the patient will die in a matter of minutes.

Some form of immediate ventilation is mandatory—mouth-to-mouth respiration or mouth-to-tube breathing or assisted ventilation using the self-inflating resuscitation bag (for example, Ambu or Hope resuscitation bag) with a mask and oral pharyngeal airway or with an endotracheal tube. During this aspect of respiratory care, automatic ventilators have no role. After resuscitation has been achieved and ventilatory needs are relatively constant, supportive measures are introduced to continue adequate oxygenation and carbon dioxide elimination. Artificial ventilators are employed at this point. In addition, efforts are directed toward the management of the underlying causes of disease—that is, precipitating events which, at least theoretically, may be reversed and improve the chances for survival.

Most commonly, acute infections, retained secretions, bronchospasm, heart failure, debility, trauma and poisonings are the precipitating events in acute respiratory failure. In chronic airway obstruction, acute infections are almost always present. Antibiotics are given from the start—ampicillin, tetracycline or high dosage penicillin directed at the most commonly involved invading bacteria (*D pneumonia* and *H influenza*). If the patient has previously been receiving antibiotic therapy and

Gram-negative rod infection is suspected, other appropriate antibiotics including kanamycin, polymyxin B or cephalothorin are administered.

A problem with retained secretions is present in almost all kinds of respiratory failure. Meticulous nasotracheal suction, suction via an endotracheal tube or tracheostomy care is fundamental for successful management. Effective removal of secretions demands atraumatic and aseptic suctioning techniques. Secretions must be removed as often as necessary. This may be as frequently as every 15 minutes, and most certainly no less often than every one to two hours. Use of the gloved hand technique and application of suction only during withdrawal of the catheter are well established principles. For removal of secretions a tracheostomal opening is usually more satisfactory than suctioning through an endotracheal tube.

In chronic airway obstruction, an element of smooth muscle spasm or bronchomucosal edema is often present. For this reason, we use parenteral xanthine (aminophyllin, 500 mg in 500 ml of water every six hours) and/or inhaled isoproterenol 1:200 or racemic epinephrine with a 1:1 or 1:2 further dilution with water to combat the reversible factors of airway obstruction. Inhalations of a bronchodilator agent may be needed as often as every one to two hours.

Congestive heart failure can precipitate acute respiratory failure.¹ On the other hand, congestive right heart failure may be a manifestation of impaired ventilation and oxygenation. Measures to clear the airways, to provide adequate oxygenation and to eliminate carbon dioxide are important principles in the management of right heart failure, which is frequently precipitated by reactive pulmonary hypertension in response to both hypoxemia and acidemia. In cor pulmonale with congestive heart failure, cardiac glycosides and rapidly acting diuretic agents may help greatly.

The pronounced debility in patients with chronic airway obstruction remains a profound problem. Managing it involves physical rehabilitation, which will be discussed later.

The effects of chest trauma often require appropriate tube drainage and occasionally surgical intervention if there is massive hemothorax or fracture of the bronchus. The crushed "flail chest" is best stabilized by employing total ventilatory support, usually with a volume cycled ventilator.

When respiratory failure occurs solely as a manifestation of poisoning, the patient should re-

ceive ventilatory support until the poison is removed either by hemodialysis or by the patient's own renal function. In the event of potentially reversible neurologic emergencies, with the administration of cholinergic drugs one can hopefully await recovery in the case of Guillain-Barré syndrome and often in acute myasthenia crisis.

Steps in the care of a patient with respiratory failure are briefly cited herein to clarify the role and responsibility of the members of the respiratory care team.

Morning rounds are conducted by the entire staff including physicians, nurses and technicians to supervise and to review the conduct of respiratory care, to check on the adequacy of equipment function and to maintain close rapport with the patient. In addition to formal rounds once daily, individual bedside checks are made frequently throughout the day by physicians and nurses of the team.

Communication with the attending staff is of great importance when one considers that the role of the consulting respiratory care unit is to supervise and adjust the ventilators as may be required to meet the changing demands for ventilation and gas exchange. Suggestions for the management of the underlying features of the disease, as previously discussed, as well as efforts toward rehabilitative aspects are all the responsibility of the consulting unit. Infections, disease problems, correction of coexisting acid-base derangements, management of cardiac arrhythmias and congestive heart failure are all included in the total management of the patient, and advice in this care is one of the duties of the consulting respiratory care team.

Since it is a consulting service, members of the respiratory care unit do not write orders unless absolutely necessary in emergency care. Close communication with the attending staff is mandatory. For this reason, oral and written communications are provided whenever a significant observation is made. This policy not only insures immediate correction of potential or existing problems, but it is also important in the training of physicians.

During the definitive therapy phase of acute respiratory care, ventilation and gas exchange are supported with equipment which provides the work of breathing. Treatment meanwhile is directed to the underlying reversible features of the disease causing the need for respiratory care.

When the patient can maintain adequate ventila-

tion on his own (as judged by bedside measurements of ventilation and blood gases), use of the ventilator is stopped for a trial period, additional oxygen being given in the inspired air. Patients are ambulated early in their course in order to maintain muscle tone and conditioning and to avoid the many complications arising from prolonged bed rest. If mechanical aid to ventilation may still be needed during early ambulation, it can be provided with the self-inflating bag still attached to the tracheostomy tube. Supplemental oxygen is often necessary even after spontaneous ventilation is sufficiently restored to permit closure of the opening in the trachea. It can be given by conventional means or, more easily, with portable oxygen equipment, which the patient can carry. As was mentioned previously, the responsibility of the respiratory care unit includes not only the early phase of rehabilitation but extended care, for success in respiratory emergencies is meaningless unless the complete care which leads to physical rehabilitation can be provided.

The potential for rehabilitation of patients who are threatened by episodes of acute respiratory insufficiency has only recently been stressed.⁵ Nearly 70 per cent of them can recover from the emergency, be transferred to ordinary wards and, if rehabilitation efforts are successful, ultimately recover to a comfortable home existence. For this reason the physical therapist plays an important part in the respiratory care team. Physical therapists should participate early in the care of patients with respiratory failure. Their role includes breathing retraining and graded exercises, including walking and general physical reconditioning, particularly in the case of patients with chronic airway obstruction who may require a prolonged recovery period.

The final stage of extended care includes the role of the public health nurse. She maintains liaison with the medical staff and supervises the still necessary (and often long-term) bronchial hygiene and inhalation therapy in the home.

Results

The results in 285 cases in which intensive care was required for respiratory failure from various causes, are shown in Table 1. An over-all salvage rate of 66 per cent was obtained despite the many desperate clinical situations encountered.

Discussion

The organizational structure of the unit and

TABLE 1.—Data on 285 Patients Dealt with by an Intensive Respiratory Care Team in a General Hospital

| Principal Diagnosis | Survived | Died* | Total |
|---|----------|-------|-------|
| 1. Severe Chronic Airway Obstruction (1st episode of respiratory failure) | 42 | 14 | 56 |
| 2. Other Pulmonary Disease | | | |
| a. Massive pneumonia | 3 | 4 | 7 |
| b. Interstitial fibrosis | 7 | 0 | 7 |
| c. Moderate chronic airway obstruction | 23 | 2 | 25 |
| 3. Surgical Problems | | | |
| a. Postoperative states | 55 | 30 | 85 |
| b. Trauma | 16 | 8 | 24 |
| c. Burns over 75 per cent of body area | 0 | 5 | 5 |
| 4. Poisonings | 17 | 8 | 25 |
| 5. Neurological emergencies | 19 | 11 | 30 |
| 6. Miscellaneous (includes cardiac arrest from various causes) | 7 | 14 | 21 |
| TOTAL: | 189 | 96 | 285 |

*Includes deaths from all causes during hospitalization.

the methods of care described do not make use of any new principles of respiratory care. They are simply the development of an organized team approach to specialized aspects of respiratory care suitable for general hospitals. In this era of specialization which employs the technical advances of new equipment for the care and monitoring of patients, highly trained personnel are needed. The development of intensive care units has proved economically feasible for the management of patients in medical emergencies of all types. This is also the case with acute respiratory failure.

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